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ABSTRACT

A difficulty associated with the use of Golub and Frederick's syntactic density score was the time required in hand tabulation. This drawback was resolved with the development by Kidder of a computer program which calculates a syntactic density score for writing samples. The purpose of this study was to examine the sensitivity of the Syntactic Density computer program as an instrument for measuring changes in language development among high school students in a writing skills instructional program. Students' pre and post writing samples were edited for spelling and punctuation and then input into the Syntactic Density computer program. Five items from the program's output were selected for analysis: total number of words, total number of T-units, words per T-unit, total score, and syntactic density score. Although significant differences were not found between pre- and post-analyses in most instances, similar results obtained on other measures in the larger study suggest this was likely due to the absence of significant change in students rather than lack of sensitivity on the part of the instrument. (BW)

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# The Use of the Syntactic Density Score as an Evaluative Criterion Measure

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## Introduction

A major problem facing evaluators of writing programs has been determining how to measure the writing itself. An examination of recent literature reveals several major trends in writing instruction and evaluation. First, the growth of knowledge and theories has led to the recognition of the complexity of written communication and the need to develop more sophisticated evaluative tools (Brown, 1980). Second, the development and assessment of written communication skills remains a concern and assumes increased importance with the emphasis on the return to basics and the measurement of minimum competencies. Furthermore, the connection between writing and reading skills is being examined by many researchers. Finally, computer technology has allowed for the expansion of instructional and evaluative capabilities. These trends have merged to influence the nature of evaluations of written communication. The purpose of the present study was to examine the use of a recently developed computer program as a research tool for evaluating the written language skills.

## Background

Theories of normal language development have been grouped generally into three categories (O'Donnell, Griffin, & Norris, 1967). The earliest, the Traditional Grammar Era, stressed sentence length, complexity of sentence structure, proportion of various parts of speech, and vocabulary as measures of language development. The Structural Grammar Era followed with its emphasis on four components of language: phonology, morphology, syntax, and semantics. Phonological units and communication units were used as indices of language development (Simms, 1979).

Most recently, the Transformational Grammar Era brought with it a continuing quest for more accurate and sensitive measures of language development. In applying transformational grammar to analysis of written language samples, Hunt (1965) described what he called the minimal terminable unit, or T-unit, as an index of syntactic maturity. Hunt defined the T-unit as a main clause and all subordinate clauses attached to or embedded within it.

Since its description, the T-unit has been used by a number of researchers in a variety of settings as a measure of syntactic maturity. Findings of these studies have led to a greater understanding of the values and limitations of the use of the T-unit as an evaluative tool as well as to important discoveries regarding the nature of language development.

Hunt, as well as others, found the most reliable predictors of syntactic maturity in written language were mean T-unit length, mean clause length, and mean number of clauses per T-unit (Heller, 1980). Jones (1979) found T-unit length and clause length to be the two most accurate indices of syntactic maturity for students spending time on sentence combining activities. Sharma (1979) found writing proficiency levels among students studying English as a second language were best distinguished by the number of error-free T-units and the number of words per error-free T-unit on a rewrite test. T-unit length and mean subordinating clauses per T-unit were used by Eblen (1981) in measuring growth in writing among college students.

Several authors have examined the reading/writing connection using the T-unit in their analysis of writing. Heller (1980) compared the written language of good and poor readers from a sample of 34 college freshmen. Good readers were found to be superior on several measures involving T-unit analysis. Hughes (1979) also found a high correlation between reading comprehension percentiles and syntactic maturity scores which included T-unit length and clauses per

T-unit. The existence and nature of such a relationship requires further examination. Stotsky (1983) emphasized this point as well as the need for new evaluative measures.

Limitations associated with the use of T-unit analysis can be found in the literature. First, research has failed to find a relationship between syntactic maturity and writing quality. Several studies confirm this, and researchers caution that measures of syntactic maturity should not be used in isolation as measures of writing quality (Chew, 1978; Crowhurst, 1980; Morenberg, 1979; Roos, 1981).

Another limitation concerns syntactic maturity ratings as they relate to mode of discourse. Davison and Lutz (1982) reported that in reading comprehension tasks, syntactic complexity is a related but not an absolute property and is affected by context. Pettegrew (1982) found that syntactic complexity varied with context (story retelling or dictation of an original story) among 30 first graders. Swiggett (1979) found differences in syntactic complexity between transactional writing and poetic writing among high school students in 8th grade and 12th grade. Crowhurst and Piché (1979) stated that T-unit analysis is more valid for argumentative and expository writing and less so for the narrative mode.

Golub and Frederick drew upon Hunt's concept of the T-unit as a measure of syntactic maturity, as well as Botel and Granowsky's weighted measure of syntactic complexity to develop what they called a syntactic density score. Ten variables were identified which correlated highly with teacher ratings of written language samples. The variables were assigned weights and their weighted frequencies tabulated to arrive at a total which was then divided by the number of T-units in the writing sample. The result was the syntactic density score. A grade level conversion was also derived and provided (Golub & Kidder, 1974).

A difficulty associated with the use of the syntactic density score was the time required in hand tabulation. This drawback was resolved with the development by Kidder of a computer program which calculates a syntactic density score for writing samples. In addition to saving vast amounts of time, the computer program was found to be more accurate than hand analysis on a number of variables, with high correlations between the two methods on the other variables (Golub & Kidder, 1974). Crump (1980) indicated the program's applicability for assessing writing.

When applied to graded reading materials through grade 7, syntactic density scores were found to be significantly different at two-year intervals and three out of six showed significant differences at one-year intervals. For writing samples through grade 6 the instrument was sensitive to most changes at two-grade-level intervals. Kidder also noted some cautions regarding peculiarities in editing of writing samples for computer analysis (Kidder, 1974).

Simms (1979) found significant effects for both age levels and groups in her study involving normal and learning disabled students. Morris and Crump (1982) in a similar study found evidence for sensitivity of the syntactic density score. Both studies employed the mathematical correction to the syntactic density score suggested by Belanger (1978) which involved dividing the first four variables by the constant 10. This procedure was designed to correct for syntactic density score changes associated with changes in the number of T-units analyzed.

## Purpose and Method of Present Study

The purpose of this study was to examine the sensitivty of the Syntactic Density computer program (Kidder, 1974) as an instrument for measuring changes in language development among high school students participating in a writing skills instructional program. The study was part of a more comprehensive preliminary evaluation of a program which was being developed to improve the

writing skills of middle and secondary students. Several instruments were examined as possible evaluative measures. Included was the Syntactic Density computer program.

The larger evaluation was based on a pretest-posttest design involving a sample of students in grades 9 through 12. For the evaluation of the Syntactic Density computer program, 10 students were selected randomly from among those included in the original sample at each grade.

Students' pre and post writing samples were edited for spelling and for punctuation according to conventional rules. Sentences and sentence fragments were kept intact. All editing was done within these constraints. Writing samples were then input into the Syntactic Density computer program.

For each writing sample, the program yielded an output which included the total number of words, total number of T-units, individual weighted frequencies for each of 10 variables, a total weighted frequency score, and a syntactic density score calculated by dividing the number of T-units into the total score (see Figure 1). The 10 weighted variables used to arrive at the total score with assigned weights shown in parentheses were words per T-unit (.95), subordinate clauses per T-unit (.90), mean main clause word length (.20), mean subordinate clause word length (.50), number of modals (e.g., will, shall, may, etc.) (.65), number of be and have forms (.40), number of prepositional phrases (.75), number of possessive nouns and pronouns (.70), number of adverbs of time (.60), and number of gerunds, participles, and absolutes (.85).

Five items from the program's output were selected for analysis. These were total number of words, total number of T-units, words per T-unit, total score, and syntactic density score. A *t* test to analyze mean gains from pre- to post-test was done for each grade level.

Figure 1

SYNTACTIC DENSITY SCORE
TABULATION SHEET

SAMPLE NO. 1

| VARIABLE NUMBER | VARIABLE DESCRIPTION | VARIABLE LOADING | | FREQUENCY | VALUE |
|---|---|---|---|---|---|
| | TOTAL NUMBER OF WORDS | | | 274 | |
| | TOTAL NUMBER OF T_UNITS | | | 32 | |
| 1. | WORDS/T-UNIT | .95 | X | 8.563 | 8.134 |
| 2. | SUBORDINATE CLAUSES PER T-UNIT | .90 | X | 0.156 | 0.141 |
| 3. | MAIN CLAUSE WORD LENGTH(MEAN) | .20 | X | 7.219 | 1.444 |
| 4. | SUBORDINATE CLAUSE WORD LENGTH (MEAN) | .50 | X | 8.563 | 4.281 |
| 5. | NUMBER OF MODALS (WILL, SHALL, MAY, ETC.) | .65 | X | 2 | 1.297 |
| 6. | NUMBER OF BE AND HAVE FORMS | .40 | X | 13 | 5.180 |
| 7. | NUMBER OF PREPOSITIONAL PHRASES | .75 | X | 36 | 27.000 |
| 8. | NUMBER OF POSSESSIVE NOUNS AND PRONOUNS | .70 | X | 13 | 9.039 |
| 9. | NUMBER OF ADVERBS OF TIME | .60 | X | 6 | 3.563 |
| 10. | NUMBER OF GERUNDS, PARTICIPLES AND ABSOLUTES | .85 | X | 12 | 10.125 |
| | TOTAL | | = | | 70.203 |
| | SD SCORE (TOTAL DIVIDED BY NUMBER OF T_UNITS) | | = | | 2.194 |

GRADE LEVEL CONVERSION TABLE

| SDS: | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 3.5 | 4.0 |
|---|---|---|---|---|---|---|---|
| GRADE LEVEL: | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

## Results

The results from the Syntactic Density computer program are presented in Table 1. The *t* test results for each of the five variables analyzed show significant gains only in 9th grade samples and only for three variables: number of words ($p < .05$), number of T-units ($p < .05$), and total weighted frequency scores ($p < .05$). No significant changes were seen in the 9th grade samples for words per T-unit or for syntactic density. The other three grades showed no significant changes on any of the five variables examined.

Effect sizes for 9th grade samples ranged from -.30 (syntactic density score) to +.85 (number of words). For 10th grade samples, effect sizes ranged from -.39 (syntactic density) to +.20 (number of words). The range of effect size for the 11th grade was -.11 (words per T-unit) to +.65 (number of T-units). At the 12th grade, effect size ranged from -.24 (number of T-units) to +.14 (words per T-unit). Although analysis across grades was not performed, a general tendency for SDS and the other four variables to increase with grade level was noted.

## Discussion

Although significant differences were not found between pre- and post-analyses in most instances, similar results obtained on other measures in the larger study suggest this was likely due to the absence of significant change in students rather than lack of sensitivity on the part of the instrument. Nonsignificant results may be accounted for, at least in part, by the fact that the instructional program had not been fully implemented at the time of evaluation. This discovery was made after the analysis of the outcome data had been completed. A question also arose concerning the time interval from pretest to posttest. In light of previous findings involving the syntactic density score, change may not be evident in a six-month time frame. This

question needs to be investigated further.

Despite a number of difficulties in the present study, the syntactic density score and its components may still demonstrate sensitivity to changes over time for this group of students. The potential for its use as a criterion measure needs to be examined under more controlled conditions. Several recommendations are made here for future study to demonstrate the usefulness of the Syntactic Density computer program.

1. Future studies should involve an experimental-control group design.

2. The mode of discourse should be controlled.

3. Belanger's mathematical correction should be applied.

4. Results should be compared with those of reading scores and with other writing sample measures such as primary trait analysis and mechanics.

5. Clearcut editing guidelines should be developed and used, including ones which correct for sources of score discrepancies addressed in previous literature.

6. Based on earlier discussions, inclusion of the vocabulary intensity measure and application of the syntactic density score to Hunt's rewrite test may also be warranted.

Table 1

Syntactical Analysis of Writing Samples

| Grade | Variable | Pretest | | Posttest | | Mean gain | Effect size | t | p |
|---|---|---|---|---|---|---|---|---|---|
| | | $\bar{X}$ | SD | $\bar{X}$ | SD | | | | |
| 9 | Number of Words | 168.0000 | 85.050 | 240.5000 | 113.435 | 72.5000 | .8524 | 3.66 | .005 |
| | Number of T-units | 14.9000 | 8.117 | 20.1000 | 8.937 | 5.2000 | .6406 | 2.27 | .049 |
| | Number of Words per T-unit | 11.7997 | 2.030 | 12.3415 | 3.827 | .5418 | .2669 | .45 | .666 |
| | Total Weighted Frequency Score | 50.3709 | 19.614 | 61.8859 | 22.371 | 11.5150 | .5871 | 2.31 | .046 |
| | Syntactic Density Score | 4.0458 | 1.953 | 3.4583 | 1.529 | - .5875 | -.3008 | - .99 | .349 |
| 10 | Number of Words | 240.2000 | 88.312 | 257.8000 | 124.001 | 17.6000 | .1993 | .56 | .588 |
| | Number of T-units | 18.9000 | 9.279 | 20.4000 | 11.965 | 1.5000 | .1617 | .44 | .669 |
| | Number of Words per T-unit | 13.7083 | 3.143 | 13.1455 | 3.298 | - .5627 | -.1790 | - .39 | .709 |
| | Total Weighted Frequency Score | 67.1138 | 18.260 | 64.8858 | 21.917 | - 2.2280 | -.1220 | - .37 | .720 |
| | Syntactic Density Score | 4.0647 | 1.450 | 3.4950 | .958 | - .5697 | -.3929 | - .99 | .346 |
| 11 | Number of Words | 248.7000 | 90.982 | 281.4000 | 93.365 | 32.7000 | .3594 | 1.29 | .228 |
| | Number of T-units | 17.2000 | 6.460 | 21.4000 | 10.146 | 4.2000 | .6502 | 2.08 | .067 |
| | Number of Words per T-unit | 15.2578 | 2.973 | 15.6879 | 2.614 | .4302 | .1447 | .49 | .639 |
| | Total Weighted Frequency Score | 66.0870 | 18.146 | 75.3164 | 17.233 | 9.2294 | .5086 | 1.65 | .133 |
| | Syntactic Density Score | 4.0758 | 1.042 | 4.1603 | 1.788 | .0845 | .0811 | .15 | .882 |
| 12 | Number of Words | 301.1000 | 105.093 | 290.8000 | 73.254 | -10.3000 | -.0980 | - .25 | .805 |
| | Number of T-units | 20.8000 | 9.114 | 18.6000 | 4.274 | - 2.2000 | -.2414 | - .70 | .504 |
| | Number of Words per T-unit | 15.2578 | 2.973 | 15.6879 | 2.614 | .4302 | .1447 | .49 | .639 |
| | Total Weighted Frequency Score | 77.5700 | 18.606 | 79.5275 | 17.157 | 1.9575 | .1052 | .26 | .802 |
| | Syntactic Density Score | 4.1781 | 1.387 | 4.3382 | .776 | .1601 | .1154 | .40 | .701 |

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